Empirical Test on the Effect of Changes In Money Supply in Developing Economies

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EMPIRICAL TEST ON THE EFFECT OF CHANGES IN MONEY SUPPLY IN DEVELOPING ECONOMIES *

Introduction

The object of this study is to draw some conclusions from the relationship between money and economic activity in thirteen developing countries for which the data were available. In the sampling procedure, we tried to select some countries from each continent, but unfortunately no country from the African Continent was chosen because of a lack of data.

Empirical tests as to whether changes in the supply of money lead to changes in demand for goods and services and further to changes in output in developing countries will provide the basis for evaluating the effect of changes in the money supply in developing economies. Although we recognize that changes in the money supply affect employment and interest rates, this article does not try to deal with these areas because of a lack of data.

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In Section 1, a summary of the test method used here is presented. Section 2 depicts the response of total demand to money supply changes. Section 3 discusses the response of price changes to total demand, which in turn indirectly involves the effect of the money supply on price. In Section 4, the response of price change to money supply is considered. In Section 5, the relation between changes in the rate of economic growth, expressed in terms of real gross national product, and changes in the price level is discussed, testing the hypothesis that underdeveloped countries can develop their economies through the inflationary process, which is a major cause of economic disturbance and instability. Finally, the study is closed with conclusions in Section 6.

Section 1. A Summary of the Test Method

The test procedure used in this article is to regress annual first rates of changes in a dependent variable against annual first rates of changes in an exogenous variable.[1/] In other words, the influence of an independent variable on a dependent variable is measured by direct estimation of a single regression equation.

There are advantages and disadvantages associated with the single equation approach. An advantage of the single equation approach is that, if an exogenous variable is correctly specified and is not itself determined by a dependent variable, it will capture the impact of an exogenous variable influence on a dependent variable, irrespective of the transmission channels.

Other major advantages, as well as, disadvantages of the single equation approach used here have been described in detail by Michael W. Keran in his "Monetary and Fiscal Influences on Economic Activity - The Historical Evidence." As he points out, there is the so-called "reverse-causation argument" against the single equation approach.[2/] This states that actions of the public, as they respond to current economic conditions, so influence observed movements in the money stock that measurements

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1/ Other measures of changes, annual first differences, annual central differences and annual central rates of changes, are not used here.

2/ Michael W. Keran, "Monetary and Fiscal Influences on Economic Activity - The Historical Evidence," Review, Federal Reserve Bank of St. Louis, November 1969.

of the relation between money and economic activity give no evidence with respect to the direction of causality. If the exogeneity assumption is not satisfied, the direction of causality is uncertain and the statistical results do not provide any evidence of the magnitude of the impact of an independent variable on a dependent variable.

An empirical study of the possible response of the money supply to economic activity does not appear in this article. A wide range of other studies have shown that the central bank can control this variable, and thus money may be treated as an exogenous variable.[3/]

There is no doubt that total demand, prices and economic growth are influenced by monetary and fiscal actions. However, the impact of fiscal actions on total demand, prices and economic growth has been ignored in this study for lack of measures of fiscal actions.

Sections 2, 3, 4, and 5 present analyses of both short-term and long-term relationships: the former consist of regression equations of year-to-year changes of dependent on independent variables. The latter consists of regressions of four to seven year changes of dependent on independent variables.

3/ Leonall C. Andersen, "Additional Empirical Evidence on the Reverse-Causation Argument," Review, Federal Reserve Bank of St. Louis, August 1969. Richard G. Davis, "How Much Does Money Matter?", Monthly Review, Federal Reserve Bank of New York, June 1969.

Only the results derived from the multiple regression analysis where we assumed a one-year time lage between the rates of change in an exogenous variable and its impact on the rates of change in a dependent variable are reported in this article. However, alternative measures of short-term relationships give substantially similar results.[4/]

In the long-term relationship analysis is a cross-sectoral test of all countries simultaneously. The test period for each country is divided into several subperiods. Each subperiod is characterized by substantially different rates of change in variables from those in the preceding or succeeding subperiods.

The single regression equation, irrespective of the sequence of the subperiods in each country and the geographical boundaries, contributes to test of the aggregate impact of an exogenous variable on a dependent variable in the long run.

Section 3. The Response of Total Demand to Money Supply[5/]

A. Short-Term Relation

Annual rates of change in total demand are regressed against annual rates of change in the money supply by the following equation:

4/ The other results are presented at the end of the Appendix.

5/ The quantity theory of money, which says that the movements in total demand are largely determined by changes in the stock of money, has recently re-emerged under the leadership of such prominent economists as professor Milton Friedman and professor Karl Brunner. John Maynard Keynes's income-expenditure theory, which says that changes in autonomous spending determines the movements in total demand and began to dominate economic thinking from the middle of the 1930's, was not considered here.

$$2.1\ \dot{Y}_t = \alpha_0 + \alpha_1 \dot{M}_t + \alpha_2 \dot{M}_{t-1}$$

where $\dot{Y}_t$ = rate of change in nominal GNP at year t[6/]

$\dot{M}_t$ = rate of change in money supply at year t

$\dot{M}_{t-1}$ = rate of change in money supply at year t-1

α_0 = constant term

α_1 and α_2 = regression coefficients of changes in total demand due to changes in money supply

As seen in Table 1, a positive relationship between changes in money supply at year t and total demand at year t occurred in nine countries out of thirteen. Six of the results are statistically significant at the five per cent level. The number of countries showing positive relationships between the changes in money supply and total demand increases to eleven due to the lagged effect of changes in the money supply on total demand. The two countries showing negative relationships were Korea and Yugoslavia.

For each country, the estimated coefficient of the money supply at year t-1 is less than that of the money supply at year t, except for the cases of Pakistan and Turkey, indicating that the relative strength of impact of money supply at year t-1 on total demand is weaker than the influence of money supply at year t on total demand.

6/ A frequently used measure of total demand is gross national product at current market prices, which should be distinguished from the actual utilization of resources measured by gross national product at constant prices.

Table 1. Indicators of Monetary($\dot{M}_t$ and $\dot{M}_{t-1}$) Influences On Total Demand ($\dot{Y}_t$)

$$\dot{Y}_t = \alpha_0 + \alpha_1 \dot{M}_t + \alpha_2 M_{t-1}$$

(Annual First Rates Of Changes)

Country	α_0	α_1	α_2	R^2	D-W
Brazil	5.87	.94	.04	.83	2.24
		(4.77)	(-.20)		
Philippines	5.08	.41	.08	.49	1.38
		(3.20)	(.74)		
Argentina	5.35	1.27	-.33	.54	1.28
		(3.75)	(-.97)		
Mexico	1.70	.77	.15	.35	2.12
		(2.38)	(.50)		
Thailand	5.56	.80	-.32	.57	2.36
		(3.20)	(-1.23)		
Spain	3.21	.53	.21	.44	2.24
		(1.62)	(.74)		
India	-5.02	.87	.77	.47	2.48
		(1.36)	(1.51)		
Colombia	3.57	.56	.17	.31	2.17
		(2.33)	(.74)		
Taiwan	11.14	.11	.03	.07	1.70
		(.67)	(.16)		
Pakistan	5.02	-.03	.35	.13	1.71
		(-.11)	(1.29)		
Turkey	11.36	-.01	.16	.02	1.29
		(-.01)	(.37)		
Korea	38.36	-.65	-.08	.28	.91
		(-1.62)	(-.18)		
Yugoslavia	27.87	-.66	.37	.58	2.35
		(-2.03)	(.95)		

Note: T statistics of regression coefficients are stated below each coefficient, enclosed by parentheses. R^2 is the percent of variation in the dependent variable which is explained by variation in the independent variable. D-W is the Durbin-Watson statistic.

The t statistic of estimated coefficient on money supply at year t is larger than that of regression coefficient on money supply at year t-1 in every country, with the exceptions of Pakistan and Turkey, showing that the more confidence we may have that changes in money supply at year t are more predictably related to changes in total demand than are changes in money supply at year t-1 related to total demand changes.

It is also noteworthy that there exists an inverse relationship between the rate of changes in total demand at year t and the rate of changes in money supply at year t-2 in seven of the thirteen countries tested, although the statistical significance of the relationship is weak and the estimated coefficient is relatively small. (See the Appendix.) Brazil, Argentina, Mexico, Thailand, Spain, Taiwan and Yugoslavia are the seven. This may be due to perverse "half cycle" influence.7/

B. Long-Term Relation

In Table 2, the same long-run relationship in each country was found to be identical to the short-run results, except in Taiwan, where a negative result exists in the long-run as opposed to a positive result in the short-run.

7/ The half-cycle influence refers to the fact that with annual data, the measured influences of lag values in money may capture the effect on income in a previous phase of the business cycle and thus have a negative coefficient. For example, the relation between changes in money in period t-2 may be negatively related to changes in income in period t.

Table 2. Long-run Monetary Influence($\dot{M}$) On Total Demand ($\dot{Y}$)
(Compounded Annual Rates of Changes)

Country	Subperiod	$\dot{M}$	$\dot{Y}$
Brazil	1950-58	21.8	22.8
	1958-66	52.7	55.2
Philippines	1950-54	.9	5.6
	1954-60	6.2	6.7
	1960-67	9.3	11.2
Argentina	1950-55	20.5	20.3
	1955-60	28.4	41.1
	1960-67	25.2	27.2
Mexico	1950-57	12.7	15.9
	1957-63	10.0	9.1
	1963-67	11.4	11.9
Thailand	1954-58	7.9	9.0
	1958-63	6.9	8.9
	1963-67	10.7	11.2
Spain	1954-60	13.4	10.5
	1960-66	14.8	15.7
India	1950-54	.1	.3
	1954-58	6.8	7.0
	1958-63	6.4	4.8
	1963-66	10.1	12.3
Colombia	1950-56	13.0	11.1
	1956-62	16.0	14.5
	1962-67	17.5	19.9
Taiwan	1955-62	17.5	15.5
	1962-67	22.8	13.1
Pakistan	1951-58	7.0	3.2
	1958-67	7.1	9.3
Turkey	1954-59	19.0	22.8
	1959-67	11.9	10.2
Yugoslavia	1952-58	....	13.1
	1958-66	19.1	22.2
Korea	1953-62	33.6	24.6
	1962-67	22.2	29.0

All countries as a group: $\dot{Y} = \alpha_0 + \alpha_1 \dot{M}$

α_0	α_1	R^2	D-W
-.39	1.01 (16.10)	.86	1.78

Note: Figure enclosed by parenthesis is t statistic. R^2 is the percent of variation in the dependent variable which is explained by variation in the independent variable. D-W is the Durbin-Watson statistic.

If all countries are regarded as a group, there is a statistically significant relationship between money supply and nominal GNP, inferring that a higher rate of change in the money supply is to a great extent related to a rising rate of change in total demand. Accordingly, the results imply the validity of the hypothesis of the positive response of total demand to money supply which is moderately strong in the short-run but very strong in the long-run.

Section 3. The Response of Price to Total Demand

A. Short-Term Relation

The response of annual rates of change in prices to rates of change in nominal GNP can be stated as follow:

$$3.1 \quad \dot{P}_t = \beta_0 + \beta_1 \dot{Y}_t + \beta_2 \dot{Y}_{t-1}$$

where $\dot{P}_t$ = rate of change in cost of living index at year t[8/]

$\dot{Y}_t$ = rate of change in nominal GNP at year t

$\dot{Y}_{t-1}$ = rate of change in nominal GNP at year t-1

β_0 = constant term

β_1 and β_2 = regression coefficients of changes in price on changes in total demand

Appling data to the above Equation 3.1 for each of the thirteen countries yields the results in Table 3. These results

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8/ The cost of living index, the wholesale price index and the gross national product implicit price deflator are used in measuring price movements. Of the three indices, the cost of living index is the best known and most widely used.

Table 3. Indicators Of Total Demand Influence ($\dot{Y}_t$ and $\dot{Y}_{t-1}$) On Price ($\dot{P}_t$)

$$\dot{P}_t = \beta_0 + \beta_1 \dot{Y}_t + \beta_2 \dot{Y}_{t-1}$$

(Annual First Rates Of Changes)

Country	β_0	β_1	β_2	R^2	D-W
Brazil	-3.30	.86	.14	.97	2.34
		(9.79)	(1.71)		
Argentina	-12.98	1.28	.05	.91	2.37
		(10.35)	(.43)		
Korea	-4.19	.63	.09	.87	1.77
		(6.15)	(.92)		
Colombia	-6.42	1.25	-.17	.76	2.89
		(6.14)	(-.88)		
Taiwan	-15.20	.98	.48	.54	1.10
		(2.17)	(1.10)		
Philippines	-4.05	.13	.70	.80	2.91
		(.86)	(5.37)		
Mexico	-5.79	.56	.30	.66	2.20
		(4.31)	(2.32)		
Turkey	-1.82	.37	.37	.48	2.29
		(2.10)	(2.13)		
India	-2.21	.50	.52	.78	1.11
		(4.34)	(4.27)		
Spain	.07	.24	.33	.41	2.02
		(1.04)	(1.44)		
Yugoslavia	-11.33	.08	1.13	.88	3.17
		(2.15)	(5.03)		
Pakistan	-2.76	.15	.68	.83	1.35
		(1.58)	(6.87)		
Thailand	-4.88	.22	.48	.66	1.38
		(1.74)	(3.89)		

Note: T statistics of regression coefficients are stated below each coefficient, enclosed by parentheses. R^2 is the percent of variation in the dependent variable which is explained by variation in the independent variable. D-W is the Durbin-Watson statistic.

show an association of high rates of change in price with growing rates of change in total demand in every country observed. Six countries out of thirteen show larger estimated coefficients of total demand at year t than those of total demand at year t-1, while six countries out of remaining seven show larger estimated coefficients of total demand at year t-1 than those of total demand at year t. In Turkey, the size of the estimated coefficient of total demand at year t is equal to that of total demand at year t-1. This indicates that the influence of total demand at year t on price is to a considerable degree as strong as that of total demand at year t-1 on price in developing countries tested.

For each country, the t statistic for the estimated coefficient of total demand, a statistical indicator of the confidence one may have that the "true" relationship between changes in total demand and price exists, is substantially large except for the case of Spain. In general, the t statistics shown in Table 3 are larger than those in any other measured relationships in this study. The above results indicate that the impact of changes in total demand on price is remarkably strong and most predictable in developing countries in the short-run.

B. Long-Term Relation

The long-term results coincide with the short-term results with the exceptions of Korea and Spain, which are discussed in detail in the Appendix.

Table 4. Long-run Total Demand Influence($\dot{Y}$) On Price($\dot{P}$)
(Compounded Annual Rates Of Changes)

Country	Subperiod	$\dot{Y}$	$\dot{P}$
Brazil	1950-58	22.8	18.3
	1958-66	55.2	53.2
Argentina	1950-55	20.3	17.6
	1955-60	41.1	38.2
	1960-67	27.2	25.3
Korea	1953-62	24.6	18.0
	1962-67	29.0	16.9
Colombia	1950-56	11.1	4.6
	1956-62	14.5	8.5
	1962-67	19.9	15.9
Taiwan	1955-62	15.5	9.7
	1962-67	13.1	1.5
Philippines	1950-54	5.6	-.8
	1954-60	6.7	1.5
	1960-67	11.2	5.1
Mexico	1950-57	15.9	8.0
	1957-63	9.1	3.8
	1963-66	11.9	3.4
Turkey	1954-59	22.8	14.5
	1959-67	10.2	6.0
India	1950-54	1.3	1.0
	1954-58	7.0	3.5
	1958-63	4.8	2.9
	1963-66	12.3	9.2
Spain	1954-60	10.5	7.3
	1960-66	15.7	7.1
Yugoslavia	1952-58	13.1	4.9
	1958-66	15.7	7.1
Pakistan	1951-58	3.2	3.2
	1958-67	9.3	3.4
Thailand	1954-58	9.0	5.7
	1958-63	8.9	-.2
	1963-67	11.2	2.7

All countries as a group: $\dot{P} = \beta_0 + \beta_1 \dot{Y}$

β_0	β_1	R^2	D-W
-5.11	.96 (19.14)	.92	1.75

Note: Figure enclosed by parenthesis is t statistic of coefficient. R^2 is the percent of variation in the dependent variable which is explained by variation in the independent variable. D-W is the Durbin-Watson statistic.

The results of combining the tested countries in a group yields: a regression coefficient of .96, t value of coefficient of 19.14, R^2 of .92 and D- of 1.75, as shown in Table 4. Therefore, we conclude that the influences on prices are not only a short-term phenomena but also a long-run phenomena.

Section 4. The Response of Price to Money Supply

A. Short-Term Relation

Annual rates of changes in price are regressed against annual rates of changes in money supply in order to test the relative importance of monetary action on prices direct by

$$4.1 \quad \dot{P}_t = \lambda_0 + \lambda_1 \dot{M}_t + \lambda_1 \dot{M}_{t-1}$$

where $\dot{P}_t$ = rate of changes in cost of living index at year t

$\dot{M}_t$ = rate of changes in money supply at year t

$\dot{M}_{t-1}$ = rate of changes in money supply at year t-1

λ_0 = constant term

λ_1 and λ_2 = regression coefficients of changes in price on changes in money supply

Although nine of thirteen countries showed the positive relationships between high rates of changes in money supply and rising rates of change in price, a weak statistical significance was found in the above results with the exceptions of Brazil, Spain, India and Philippines where t statistics were significantly large at five per cent level and R^2 of .81, .75, .67 and .62 were shown, respectively. (See Table 5.)

Table 5. Indicators Of Monetary Influence ($\dot{M}_t$ and $\dot{M}_{t-1}$) On Price (P_t)

$$\dot{P}_t = \lambda_0 + \lambda_1 \dot{M}_t + \lambda_2 \dot{M}_{t-1}$$

(Annual First Rates Of Changes)

Country	λ_0	λ_1	λ_2	R^2	D-W
Brazil	1.32	.79	.15	.81	2.17
		(3.97)	(.75)		
Argentina	1.54	1.59	-.55	.48	1.77
		(3.18)	(-1.06)		
India	-3.80	.00	1.27	.67	2.26
		(.01)	(3.98)		
Philippines	-.49	.12	.37	.62	1.22
		(1.09)	(4.14)		
Mexico	-1.22	.45	.05	.19	1.68
		(1.63)	(.22)		
Spain	-.57	-.02	.59	.75	2.42
		(-.16)	(4.50)		
Thailand	-.48	.05	.26	.20	1.43
		(.25)	(1.28)		
Colombia	-4.61	.59	.33	.18	2.66
		(1.56)	(.90)		
Pakistan	.38	-.03	.32	.19	1.72
		(-.19)	(1.62)		
Korea	26.80	-.53	-.15	.39	.63
		(-2.00)	(-.50)		
Taiwan	11.43	-.27	-.07	.15	.78
		(-1.02)	(-.25)		
Yugoslavia	17.48	-.54	.31	.27	1.83
		(-1.16)	(.54)		
Turkey	5.04	.10	.16	.05	1.62
		(.41)	(.65)		

Note: T statistics of regression coefficients are stated below each coefficient, enclosed by parentheses. R^2 is the percent of variation in the dependent variable which is explained by variation in the independent variable. D-W is the Durbin-Watson statistic.

It is not obvious whether the impact of changes in money supply at year t on price is stronger and more predictable than that of changes in money supply at year t-1 on price or true is vice versa.

Three countries having negative relationships between changes in money supply and price are Yugoslavia, Korea and Taiwan. In Yugoslavia, the price change was found to respond apparently to the changes in industrial production and importance of goods and services.[9/] Korea and Taiwan, being the exceptional cases, are discussed in the Appendix.

B. Long-Term Relation

On a long-term basis, prices of all tested countries except Spain and Taiwan positively responded to changes in the money supply. By viewing the countries as a group, the results obtained were a regression coefficient of 1.04, t value of coefficient of 12.02, R^2 of .83 and D-W of 1.41. (Refer to Table 6.) The Appendix also deals with the exceptions of Spain and Taiwan. Clearly, the association between changes in money and changes in prices is much closer in the long-run than in the short-run. This observation is in conformity with Modern Quantity theory of money which asserts that money will affect real variables in the short-run, but only prices in the long-run.

9/ The rate of change in price was compared with the rates of changes in industrial production and imports on an annual basis

Table 6. Long-term Money Supply Influence ($\dot{M}$) On Price ($\dot{P}$)
(Compounded Annual Rates Of Changes)

Country	Subperiod	$\dot{M}$	$\dot{P}$
Brazil	1950-58	21.8	18.3
	1958-66	52.7	53.2
Argentina	1950-55	20.5	17.6
	1955-60	28.4	38.2
	1960-67	25.2	25.3
India	1950-54	.1	.0
	1954-58	6.8	3.5
	1958-63	6.4	2.9
	1963-66	10.1	9.2
Philippines	1950-54	.9	-.8
	1954-60	6.2	1.5
	1960-67	9.3	5.1
Mexico	1950-57	12.7	8.0
	1957-63	10.0	3.8
	1963-67	11.4	3.4
Spain	1954-60	13.4	7.3
	1960-66	14.8	7.1
Thailand	1954-58	7.9	5.7
	1958-63	6.9	-.2
	1963-67	10.7	2.7
Colombia	1950-56	13.0	4.6
	1956-62	16.0	8.5
	1962-67	17.5	15.9
Pakistan	1951-58	7.0	3.2
	1958-67	7.1	3.4
Korea	1953-62	33.6	18.0
	1962-67	22.1	16.9
Taiwan	1955-62	17.5	9.7
	1962-67	22.8	1.5
Yugoslavia	1952-58	....	4.9
	1958-66	19.1	12.6
Turkey	1954-59	19.0	14.5
	1959-67	11.9	6.0

All countries as a group: $\dot{P} = \lambda_0 + \lambda_1 \dot{M}$

λ_0	λ_1	R^2	D-W
-5.26	1.04 (12.02)	.83	1.41

Note: Figure enclosed by parenthesis is t statistic of coefficient. R^2 is the percent of variation in the dependent variable which is explained by variation in the independent variable. D-W is the Durbin-Watson statistic.

Section 5. Inflation and Economic Growth

A. Short-Term Relation

In order to determine whether high rates of economic growth are related to high rates of increase in prices on a short-term basis, Equation 5.1 is constructed as follow:

$$5.1 \quad \dot{Y}^*_t = \rho_0 + \rho_1 \dot{P}_t + \rho_2 \dot{P}_{t-1}$$

where $\dot{Y}^*_t$ = rate of changes in real GNP at year t

$\dot{P}_t$ = rate of changes in price at year t

$\dot{P}_{t-1}$ = rate of changes in price at year t-1

ρ_0 = constant term

ρ_1 and ρ_2 = regression coefficients of changes in real GNP on changes in price

As seen in Table 7, two countries out of thirteen show a positive relationship between a change in prices and a change in economic growth. The two are Korea and Mexico where a sum of estimated coefficients of .22 and .19 and a t value of sum of estimated coefficients of 2.20 and .45 were shown respectively. (See Table 21 in the Appendix.)

The t value of regression coefficient is insignificant in all countries showing a negative relationship between a change in prices and a change in economic growth with the exceptions of Yugoslavia and Spain, indicating we may not have confidence that a "true" relationship between a change in prices and a change in economic growth exists in the short-run.

Table 7. Indicators Of Price Influence ($\dot{P}_t$ and $\dot{P}_{t-1}$) On Economic Growth ($\dot{Y}_t$)

$\dot{Y}_t = \rho_0 + \rho_1 \dot{P}_t + \rho_2 \dot{P}_{t-1}$

(Annual First Rates Of Changes)

Country	ρ_0	ρ_1	ρ_2	R^2	D-W
Pakistan	4.09	.28	-.27	.38	1.81
		(1.69)	(-1.62)		
Turkey	4.91	.10	-.05	.05	1.66
		(.52)	(-.25)		
Korea	3.87	.16	.10	.40	1.14
		(1.59)	(1.14)		
Mexico	3.78	.43	.28	.23	2.58
		(1.50)	(1.14)		
Yugoslavia	15.31	-.45	-1.72	.59	1.77
		(-.91)	(-2.90)		
Colombia	3.91	-.01	.08	.29	1.52
		(-.23)	(1.23)		
Spain	10.29	.52	-.90	.77	1.45
		(1.29)	(-3.19)		
India	8.14	-.10	-.17	.14	1.79
		(-.50)	(-.85)		
Philippines	8.26	-.74	-.29	.37	2.51
		(-1.53)	(-.70)		
Taiwan	10.89	-.14	-.19	.55	1.82
		(-1.21)	(-1.72)		
Argentina	5.25	-.11	.05	.31	2.32
		(-2.00)	(.95)		
Brazil	9.15	-.09	.01	.16	3.12
		(-.86)	(.09)		
Thailand	8.41	-.97	-.32	.73	1.51
		(-3.05)	(-1.21)		

Note: T statistics of regression coefficients are atated below each coefficient, enclosed by parentheses. R^2 is the percent of variation in the dependent variable which is explained by variation in the independent variable. D-W is the Durbin-Watson statistic.

B. Long-term Relation

From the preceding results, it seems apparent that when viewing the effect of changes in price on economic growth, it is more valuable to take a long-term view.

As a result of long-term analysis in each country, Turkey, Mexico, Yugoslavia, and Argentina show a positive relationship between changes in price and changes in economic growth.

Eight other countries, Pakistan, Korea, Taiwan, Spain, Colombia, India, Philippines, Brazil, and Thailand, show an inverse relationship between the rate of change in price and the rate of change in economic growth. Half of these countries, Korea, Pakistan, Spain, and Taiwan, show a decreasing rate of change in price and an increasing rate of change in economic growth, while the remaining four countries show a rising rate of change in price and a declining rate of change in economic growth.

If all countries are considered as a group, the relationship between the rate of change in price and the rate of change in economic growth seems to be inverse. However, the statistical significance of the relationship is too weak to be conclusive, with a regression coefficient of -.05, t value of price change coefficient of -1.21, R^2 of .06, and D-W of 1.93.

Regardless of whether the response of change in economic growth rate to the rate of change in price is positive or negative, it is noticeable that Korea, Mexico, Pakistan, Spain, Taiwan, and Yugoslavia are attaining the goal of economic growth at an accelerated rate in recent years. (See Table 8.)

Table 8. Long-term Price Influence ($\dot{P}$) On Economic Growth ($\dot{Y}$)
(Compounded Annual Rates Of Changes)

Country	Subperiod	$\dot{P}$	$\dot{Y}$
Pakistan	1951-58	3.2	2.2
	1958-65	2.0	5.1
Turkey	1955-59	9.7	6.7
	1959-65	4.3	4.3
Korea	1953-62	18.0	4.7
	1962-67	16.9	9.4
Mexico	1950-57	8.0	6.5
	1957-63	3.8	5.1
	1963-65	3.1	7.9
Yugoslavia	1952-58	4.9	7.4
	1958-64	7.8	9.5
Colombia	1950-56	4.6	5.0
	1956-62	8.5	4.3
	1962-65	17.1	4.2
Spain	1954-60	7.3	3.1
	1960-64	5.6	9.8
India 1/	1950-54	.0	8.4
	1954-58	3.5	7.1
	1958-62	2.9	9.2
	1962-66	9.2	6.4
Philippines	1950-54	-.8	4.7
	1954-60	1.5	6.0
	1960-66	5.0	4.4
Taiwan	1955-62	9.7	6.9
	1962-67	1.5	10.8
Argentina	1950-55	17.6	3.0
	1955-60	38.2	3.2
	1960-66	24.6	2.6
Brazil 2/	1950-58	18.3	5.5
	1958-66	53.2	5.0
Thailand 2/	1954-58	5.7	....
	1958-63	-.2	8.0
	1963-65	1.5	7.9

All countries as a group: $\dot{Y} = \rho_c + \rho_1 \dot{P}$

ρ_c	ρ_1	R^2	D-W
5.59	-.05 (-1.21)	.06	1.93

1/ Real GNP has been substituted by Industrial Production Index.
2/ Real GNP has been replaced by Real Domestic Products.
Note: Figure enclosed by parenthesis is t statistic of coefficient. R^2 is the percent of variation in the dependent variable which is explained by variation in the independent variable. D-W is the Durbin-Watson statistic.

For convenience, inflationary levels in the countries observed have been categorized into four groups: None (annual rate of change in price is less than 2%), small (2-4%), moderate (4-15%), and high inflation (more than 15%).

Table 9 shows that five of the six countries showing the attainment of economic growth at an accelerated rate in recent years fall into the moderate inflation group. Korea, Mexico, Spain, Taiwan, and Yugoslavia are the five. A comparison of the average rate of change in economic growth among inflation groups shows that a higher rate of economic growth is common to neither the small inflation nor high inflation groups but rather to the moderate inflation countries. 10/ This result coincides with the evidence of the article written by Graeme S. Dorrance. He concluded, from an empirical point of view, that deflation or small price increases and strong inflation both appear to be inconsistent with relatively rapid growth, although his definition of strong inflation is not identical to high inflation in this study. 11/

As a consequence, we may conclude that the response of the rate of change in economic growth to the rate of change in

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10/ This does not necessarily mean that the optimum rate of change of prices lies somewhere between 4-15% per annum. We dare not to estimate the optimum rate of change of prices associated with higher economic growth rate.

11/ Graeme S. Dorrance, "Inflation and Growth: The Statistical Evidence," IMF Staff Papers, March 1966.
Mr. Dorrance examined the relationship between growth and inflation in 48 member countries of the International Monetary Fund. He defined strong inflation as price increases of more than 10 per cent per annum.

Table 9. Inflation and Economic Growth Rate
(Compounded Annual Rates Of Changes)

Group	Rate of Price change	Country	Economic Growth Rate	Period
None				
Small				
	2.1	Thailand	5.7 1/	1953-65
	2.2	Philippines	5.1	1950-66
	2.7	Pakistan	3.6	1950-65
	3.9	India	6.8 2/	1951-66
	(2.7)		(5.3)	
Moderate				
	5.6	Mexico	6.1	1950-65
	6.2	Taiwan	8.5 1/	1955-67
	7.0	Spain	6.4	1956-64
	8.6	Colombia	4.5	1950-65
	8.8	Turkey	5.4	1955-65
	9.4	Yugoslavia	8.6	1955-65
	12.6	Korea	6.4	1955-67
	(8.3)		(6.6)	
High				
	26.4	Argentina	2.9	1950-66
	34.6	Brazil	5.3 1/	1950-66
	(30.5)		(4.1)	

1/ Economic growth rate is expressed in terms of rate of change in real gross domestic products.
2/ Real GNP is replaced by Industrial Production Index.
3/ Figures enclosed by parentheses represent average rate of change in each group.

price tends to be ambiguous in the developing countries in the long run.

Section 6. Conclusion

If a study does not recognize its limitation, it does not contribute to progress. Hence, in this section we shall briefly summarize the major limitations, as well as the conclusions of the study.

The single equation approach used here can deal with only a single question. It does not distinguish between the direct and indirect impacts of monetary influences on prices, total demand, and economic growth or how subsectors of the economy are affected. 12/

The monetary policy decisions of the authorities are not necessarily explained by the single equation approach. The statistical results do not provide any evidence with respect to the issue as to whether the monetary variable could be dominated by the actions of monetary authorities or not. 13/

We have assumed that the possible response of the money supply to economic activity does not appear to influence in any appreciable manner the regression coefficients of the change in GNP on the change in money, and that money supply may be treated as an exogenous variable in the developing countries. The reliability of this assumption is to some extent

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12/ Michael W. Keran, "Monetary and Fiscal Influences on Economic Activity - The Historical Evidence," Review, Federal Reserve Bank of St. Louis, November 1969.

13/ Michael W. Keran, Ibid.

questionable, due mainly to the nonexistence of the study as to whether money is little influenced by economic activity, and, as a consequence, can be treated as an exogenous variable in developing countries. We hope that further research will usefully explore this issue.

In Sections 2, 3, and 4, the determination of total demand and price level is explained by monetary-centered approach and demand-centered approach, neglecting the effects of fiscal actions and supply on the determination of total demand and price level, in order to concentrate our efforts on tracing the effect of changes in money supply in developing economies. This issue should be also supplemented further by fiscal and supply-centered approaches.

The major conclusions of this study are: First, the effect of a change in money supply on a change in total demand is significantly positive in developing countries. Second, a change in money supply influences a change in total demand in the same direction, and then the latter exerts a strong influence on changes in prices in the same direction. The statistical significance of the relationship between a change in total demand and a change in price is stronger than that of any other relationship tested in the study. Third, the direct effect from a change in money supply on a change in prices is statistically significant; however, this is weaker than indirect impact of monetary action on price, which can be measured by decomposition into the direct effect of money supply on total demand and a direct effect of total demand on price. Finally, economic development through the

inflationary process in developing countries is uncommon, and economic growth rather tends to respond inversely to changes in prices. Higher rates of economic growth are most common in the countries where neither the price level remains stable nor a highly inflationary process persists, but the price level changes moderately.

Appendix 1. Korea

We have seen the existence of a strong response in total demand to a change in money supply, a significant response of a change in prices to a change in total demand, and a remarkable association of a change in price with a change in money supply in developing countries. However, the Korean economy has experienced an inverse movement between a change in total demand and a change in price in the long run. A negative relationship between a change in money supply and a change in total demand both in the short run and in the long run was also experienced by the Korean economy. Korea showed the inverse response of a change in price to a change in money supply in the short run.

Although it is quite difficult in the long run to explore the relevant exogenous variable which is believed to exert influence on total demand in Korea, the rate of change in total demand was found to associate with the rate of change in money supply for the period of 1953-62. Since 1962, the rate of change in money supply ceased to exert its influence on a change in total demand. It is quite interesting to see the association of a change in total demand with either a change in rice production or capital inducement for the period of 1962-67, as seen in Table 10.

In Korea, the rate of change in price is apparently influenced by a change in industrial production and the import of goods and services from abroad (See Table 11). Recently, Korea enjoys a somewhat reduced rate of price increase due mainly to an increasing rate of industrial production and a higher rate of increase in importation of goods and services. In addition, the execution of a commodity budget for key commodities such as rice, cement, and cotton yarn, along with the implementation of sound fiscal and monetary policies and strict control over monopolistic practices, have contributed materially to the maintenance of price stability. 14/

In the long run, a positive relationship between a change in money supply and a change in price exists. Until 1962, short-run changes in the money supply exerted a positive influence on price. Hereafter, the influence of a change in money supply on a change in price seemed to cease and were replaced by industrial production and imports.

Breaking the period of 1962-67 into the subperiods, 1962-64 and 1964-67, we can explore the possible reasons for the inverse relationship between a change in money supply and a change in price for the period of 1962-67.

During the subperiod of 1962-64, the money supply increased by 12.5 percent, while the rate was 20.3 percent in the preceding subperiod of 1958-62. On the contrary to diminishing rate of change in money supply, higher rate of price change was experienced in Korea. The inverse relationship between the rate of change in money supply and the rate of change in price during the subperiod of 1962-64 was a result of the following factors:

14/ Bank of Korea, Review of Korean Economy, 1965-29.

a. Poor harvest of rice, barley and wheat.

b. Decrease in imports (-2.6%).

c. Decrease in foreign exchange holdings (-12.1%) - prospect for import restriction - psychological effect.

d. Devaluation of Won currency effective on May 3, 1964 from 130 Won to 255.5 Won per U.S. dollar.

e. Decreased rate of increase in industrial production, from 11.4 percent in the preceding period to 10.8 percent on an annual basis.

The money supply increased by 35.2 percent at the compounded annual rate during the subperiod of 1964-67 compared with a 12.5 percent increase in the preceding subperiod of 1962-64. Meanwhile, the diminishing rate of price change, from 24.8 percent during 1962-64 to 12.0 percent during 1964-67, was primarily attributable to the following factors:

a. Increase in imports (34.9%).

b. Increase in industrial production (33.7%).

c. Increase in foreign exchange holdings (39.1% reflecting the large quantity of foreign exchange receipts related to the Vietnam War.

d. Stable price of grain.

e. Slight change in the value of Won expressed in terms of U.S. dollar, from 255.5 Won to 274.6 Won per U.S. dollar.

Appendix 2. Spain

Between the periods of 1954-60 and 1960-66, Spain experienced a negative response of a change in price to either a change in total demand or a change in money supply, as shown in Table 12.

Table 10. Indicators Of Monetary and Other Influences On Total Demand In Korea

(Compounded Annual Rates Of Changes)

Period	Subperiod	Total Demand	Money Supply	Rice Production	Capital Inducement 1/	Government Expenditure
1953-62		24.6	33.6		16.0	
		(22.9)	(27.6)	(.3)	(18.1)	(31.4)
	1953-54	38.8	93.3	....	.0	....
	1954-55	73.5	63.8	....	.0	55.0
	1955-57	30.5	27.7	.7	.0	57.6
	1957-58	4.8	26.5	5.3	.0	24.7
	1958-60	9.1	11.8	-1.8	8.3	-2.4
	1960-62	18.9	29.1	-.5	3.8	39.5
1962-67		29.0	24.1	3.6	132.9	17.3
	1962-63	40.0	1.5	24.6	403.6	-16.8
	1963-65	28.5	25.0	-3.5	-2.9	22.3
	1965-66	28.1	30.1	11.9	346.3	35.2
	1966-67	20.7	42.5	-8.1	8.2	32.0

1/ The amount of capital inducement is measured on an arrival basis and accordingly, does not coincide with the figures on an approval basis.

Note: Figures enclosed by parentheses show the compounded annual rates of changes during 1954-62.

Table 11. Indicators Of Impact Of Variable On Price In Korea
(Compounded Annual Rates Of Changes)

Period	Subperiod	Price 1/	Total Demand	Industrial Production	Imports 2/	Money Supply
1953-62		18.0	24.6	14.0	2.9	33.6
	1953-54	41.4	38.8	14.6	-30.4	93.3
	1954-56	43.1	50.9	21.0	27.6	46.8
	1956-58	9.1	16.6	12.5	.7	25.2
	1958-60	5.8	9.1	11.8	-3.1	11.8
	1960-62	7.3	18.9	11.0	9.6	29.1
1962-67		16.9	29.0	24.0	18.4	24.1
	1962-64	24.8	41.4	10.8	-2.6	9.1
	1964-65	13.4	15.6	17.5	12.0	33.1
	1965-67	11.2	24.3	42.7	48.0	36.2

1/ Price is expressed in terms of Cost of Living Index.
2/ Imports of goods and services on a settlement basis.

Table 12. Indicators Of Influencing Factors On Total Demand And Price In Spain
(Compounded Annual Rates Of Changes)

Period	Subperiod	Nominal GNP	Price [1]	Money Supply	Industrial Production	Imports [2]
1954-60		10.5	7.3	13.4	7.2	4.1
	1954-55	10.1	4.2	14.3	12.9	....
	1955-57	16.6	8.3	22.6	7.3	13.5
	1957-58	13.6	13.6	10.5	9.9	2.5
	1958-59	.9	7.0	9.7	5.0	-4.5
	1959-60	6.0	2.8	2.1	1.0	-3.1
1960-66		15.7	7.1	14.8	12 5	28.1
	1960-62	13.8	2.7	13.4	12.0	38.8
	1962-63	18.0	10.3	14.0	12.0	25.3
	1963-64	13.3	7.0	18.4	14.8	15.6
	1964-65	21.0	13.9	16.5	10.5	32.4
	1965-66	14.5	6.4	13.2	13.8	19.4

1/ Price is expressed by Cost of Living Index.
2/ Imports of goods and services on a settlement basis.

In Spain, the rate of change in price is likely to be influenced by the rate of change in industrial production and imports of goods and services in the long run as it is in Korea. However, in the short run, the rate of change in price tended to associate positively with a change in money supply until the period of 1959-60.

Appendix 3. Taiwan

An inverse relationship between a change in total demand and a change in money supply, and an inverse response of a change in price to a change in money supply were experienced in Taiwan, in the long run.

In Taiwan, the rate of change in total demand tends to respond to the rate of change in government expenditures, as shown in Table 13, on a long-term basis.

In the long run, the rate of change in price is closely related to industrial production and the importation of goods and services in Taiwan as in Korea and Spain, and money does not tend to be an influencing factor in price change.

APPENDIX 4: ALTERNATIVE ESTIMATES OF THE FOLLOWING RELATIONSHIPS:

1. Monetary influence on total demand
2. Total demand influence on prices
3. Monetary influence on prices
4. Price influences on economic growth

Note: Each relationship is estimated simultaneously, and with the Almon-distributed lag program.

Table 13. Indicators Of Influencing Factors On Total Demand And Price In Taiwan

(Compounded Annual Rates Of Changes)

Period	Subperiod	Total Demand	Price	Money Supply	Industrial Production	Imports	Government Expenditure
1955-62		15.5	9.7	17.5	10.8	8.7	15.4 1/
	1955-59	16.7	9.9	21.5	9.7	9.4	
	1959-62	13.9	9.3	12.5	12.3	8.3	
1962-67		13.1	1.5 2/	22.8	17.0	18.1	14.3 1/
	1962-64	15.8	1.0	30.2	17.8	12.9	
	1964-67	11.4	1.8	18.1	16.4	21.7	

1/ Average annual rates of changes is shown.

2/ Rebated increasing rate of expenditures for communication services and diminished expenditures for medical care contributed to reduced rate of price increase during 1962-67.

Table 14. Indicators of Monetary influence ($\dot{M}_t$) On Total Demand ($\dot{Y}_t$)

$$\dot{Y}_t = \alpha_0 + \alpha_1 \dot{M}_t$$

(Annual First Rates of Changes)

Country	α_0	α_1	R^2	D-W	Period
Brazil	4.21	.93 (8.71)	.84	2.15	50-66
Philippines	5.61	.43 (4.11)	.53	1.28	50-67
Argentina	.90	1.16 (4.01)	.52	1.47	50-67
Mexico	3.73	.73 (3.96)	.51	2.50	50-67
Thailand	4.58	.61 (2.78)	.41	2.71	54-67
Spain	5.36	.55 (2.40)	.37	2.28	54-66
India	1.83	.73 (2.29)	.29	2.52	51-66
Colombia	10.31	.30 (1.65)	.15	1.89	50-67
Taiwan	11.76	.15 (1.10)	.12	1.66	56-67
Pakistan	5.55	.19 (.97)	.06	1.28	51-67
Turkey	10.88	.26 (.77)	.06	1.11	55-67
Korea	29.11	-.26 (-.84)	.07	1.17	55-67
Yugoslavia	31.43	-.46 (-1.95)	.39	1.41	58-66

Note: T statistics of regression coefficients are stated below each coefficient, enclosed by parentheses. R^2 is the per cent of variation in the dependent variable which is explained by variation in the independent variable. D-W is the Durbin-Watson statistic.

Table 15. Indicators of Monetary ($\dot{M}_t$, $\dot{M}_{t-1}$ and $\dot{M}_{t-2}$) Influences On Total Demand ($\dot{Y}_t$)

$$\dot{Y}_t = \alpha_0 + \alpha_1 \dot{M}_t + \alpha_2 \dot{M}_{t-1} + \alpha_3 \dot{M}_{t-2}$$

(Annual First Rates of Changes-Almon Lag Results)

Country	α_0	α_1	α_2	α_3	$\Sigma\alpha$	R^2	D-W
Brazil	7.31	.77	.34	-.26	.84	.74	2.13
	(1.00)	(4.14)	(5.21)	(-1.41)	(5.21)		
Philippines	3.45	.29	.29	.15	.74	.45	1.64
	(2.13)	(2.58)	(3.52)	(1.57)	(3.52)		
Argentina	5.76	.75	.38	-.18	.96	.34	1.82
	(.43)	(2.96)	(1.91)	(-.69)	(1.91)		
Mexico	9.29	.42	.11	-.25	.28	.12	1.27
	(1.55)	(1.69)	(.53)	(-1.13)	(.53)		
Thailand	6.67	.48	.09	-.35	.22	.27	2.01
	(1.70)	(5.26)	(.43)	(-1.16)	(.43)		
Spain	4.50	.66	.27	-.25	.68	.40	2.73
	(.85)	(2.70)	(1.75)	(-1.30)	(1.75)		
India	-5.48	.56	.68	.46	1.70	.39	2.54
	(-1.19)	(1.47)	(2.96)	(1.66)	(2.96)		
Colombia	-5.14	.50	.51	.27	1.28	.27	2.21
	(-.60)	(2.28)	(2.50)	(1.28)	(2.50)		
Taiwan	10.07	.04	.08	-.26	.20	-.26	1.74
	(1.46)	(.30)	(.55)	(-.56)	(.55)		
Pakistan	6.09	.09	.13	.10	.32	-.11	2.07
	(1.79)	(.45)	(.89)	(.50)	(.89)		
Turkey	1.97	-.12	.35	.65	.88	.44	1.75
	(.28)	(-.41)	(1.59)	(2.98)	(1.59)		
Korea	29.01	-.29	-.13	.10	-.33	-.08	1.13
	(2.23)	(-1.09)	(-.62)	(.46)	(-.62)		
Yugoslavia	20.48	-.00	-.00	-.00	-.00	-.19	2.11
	(4.88)	(-.28)	(-.63)	(-.54)	(-.63)		

Note: T statistics are shown below intercepts, coefficients and sum of coefficients, enclosed by parentheses. R^2 is the per cent of variation in the dependent variable which is explained by variation in the independent variable. D-W is the Durbin-Watson statistic.

Table 16. Indicators of Total Demand Influence ($\dot{Y}_t$) On Price ($\dot{P}_t$)

$$\dot{P}_t = \beta_0 + \beta_1 \dot{Y}_t$$

(Annual First Rates of Changes)

Country	β_0	β_1	R^2	D-W	Period
Brazil	-1.79	.96 (13.73)	.93	2.32	50-66
Argentina	-8.56	1.23 (8.79)	.84	2.55	50-67
Korea	-3.09	.72 (6.92)	.83	1.96	55-67
Colombia	-9.93	1.30 (6.81)	.76	2.98	50-67
Taiwan	-4.25	.71 (5.78)	.71	1.37	51-67
Philippines	-3.99	.78 (3.81)	.49	2.08	50-67
Mexico	-1.29	.54 (3.61)	.47	2.32	50-67
Turkey	-.47	.68 (3.38)	.53	1.96	55-67
India	.86	.50 (3.18)	.42	1.70	50-66
Spain	2.45	.37 (1.79)	.24	1.25	54-66
Yugoslavia	2.19	.39 (1.54)	.17	1.71	52-66
Pakistan	2.67	.11 (.59)	.02	1.91	50-67
Thailand	3.58	.03 (.11)	.00	.84	50-67

Note: T statistics of regression coefficients are shown below each coefficient, enclosed by parentheses. R^2 is the per cent of variation in the dependent variable which is explained by variation in the independent variable. D-W is the Durbin-Watson statistic.

Table 17. Indicator of Total Demand Influence ($\dot{Y}_t$, $\dot{Y}_{t-1}$ and $\dot{Y}_{t-2}$) On Price ($\dot{P}_t$)

$$\dot{P}_t = \beta_o + \beta_1 \dot{Y}_t + \beta_2 \dot{Y}_{t-1} + \beta^3 \dot{Y}_{t-2}$$

(Annual First Rates of Changes - Almon Lag Results)

Country	β_o	β_1	β_2	β_3	$\Sigma\beta$	R^2	D.W.
Brazil	-2.93	.71	.39	-.12	.98	.94	1.92
	(-.82)	(9.52)	(13.08)	(1.69)	(13.08)		
Argentina	-6.85	.96	.46	-.27	1.15	.74	2.76
	(-.75)	(6.25)	(4.13)	(-1.81)	(4.13)		
Korea	-5.29	.49	.32	-.02	.79	.71	2.49
	(-1.32)	(4.62)	(4.86)	(-.27)	(4.86)		
Colombia	-3.91	.95	.36	-.42	.89	.50	2.79
	(-.52)	(3.81)	(1.87)	(-1.79)	(1.87)		
Taiwan	-22.52	.77	.78	.39	1.95	.51	1.56
	(-2.49)	(2.45)	(3.13)	(1.27)	(3.13)		
Philippines	-3.75	.29	.33	.21	.83	.58	3.36
	(-2.28)	(1.70)	(4.45)	(1.32)	(4.45)		
Mexico	-4.16	.53	.29	-.10	.73	.53	2.96
	(-1.33)	(4.09)	(2.91)	(-.82)	(2.91)		
Turkey	-3.93	.51	.36	.04	.91	.54	2.33
	(-.94)	(2.88)	(3.30)	(.22)	(3.30)		
India	-2.56	.53	.44	.13	1.09	.73	1.57
	(-1.71)	(4.70)	(5.45)	(1.13)	(5.45)		
Spain	-3.88	.17	.35	.36	.88	.59	2.51
	(-1.18)	(1.24)	(3.60)	(2.51)	(3.60)		
Yugoslavia	-13.86	.46	.54	.34	1.34	.68	3.28
	(-2.52)	(2.75)	(4.67)	(1.83)	(4.67)		
Pakistan	-6.65	.48	.52	.31	1.31	.68	2.48
	(-3.26)	(4.22)	(5.18)	(3.13)	(5.18)		
Thailand	-9.16	.33	.46	.36	1.16	.48	2.48
	(-2.70)	(2.40)	(3.19)	(2.46)	(3.19)		

Note: T statistics are shown below intercepts, coefficients and sum of coefficients, enclosed by parentheses. R^2 is the percent of variation in the dependent variable which is explained by variation in the independent variable. D-W is the Durbin-Watson statistic.

Table 18. Indicators of Monetary Influence ($\dot{M}_t$) on Price ($\dot{P}_t$)

$$\dot{P}_t = \lambda_o + \lambda_1 \dot{M}_t$$

(Annual First Rates of Changes)

Country	λ_o	λ_1	R^2	D-W	Period
Brazil	2.13	.89 (7.13)	.77	2.32	50-67
Argentina	3.55	1.26 (2.69)	.34	1.94	51-67
India	1.18	.55 (2.02)	.23	1.14	51-67
Philippines	.75	.28	.18	1.93	50-27
Mexico	2.16	.29 (1.41)	.12	2.10	50-67
Spain	4.30	.20 (1.01)	.09	1.64	54-67
Thailand	1.45	.13 (.67)	.04	1.14	54-67
Colombia	6.35	.20 (.70)	.03	2.21	50-67
Pakistan	3.17	.04 (.25)	.00	1.80	51-67
Turkey	8.07	-.04 (-.17)	.00	1.24	50-67
Korea	17.29	-.17 (-.68)	.04	1.16	55-67
Taiwan	8.92	-.18 (-.80)	.07	1.08	55-67
Yugoslavia	18.97	-.38 (1.31)	.20	1.45	58-67

Note: T statistics of regression coefficients are shown below each coefficient, enclosed by parentheses. R^2 is the percent of variation in the dependent variable which is explained by variation in the independent variable. D-W is the Durbin-Watson statistic.

Table 19. Indicators of Monetary Influence ($\dot{M}_t$, $\dot{M}_{t-1}$ and $\dot{M}_{t-2}$) On Price ($\dot{P}_t$)

$$\dot{P}_t = \lambda_0 + \lambda_1 \dot{M}_t + \lambda_2 \dot{M}_{t-1} + \lambda_3 \dot{M}_{t-2}$$

(Annual First Rates Of Changes - Almon Lag Results)

Country	λ_0	λ_1	λ_2	λ_3	$\Sigma\lambda$	R^2	D-W
Brazil	1.87	.65	.37	-.09	.91	.75	1.97
	(.26)	(3.59)	(5.76)	(-.57)	(5.76)		
Argentina	-3.93	.83	.50	-.08	1.25	.18	2.16
	(-.19)	(2.14)	(1.64)	(-.20)	(1.64)		
India	-2.44	-.13	.43	.78	1.07	.73	2.75
	(-1.02)	(-.66)	(3.58)	(5.38)	(3.58)		
Philippines	-.81	.20	.23	.15	.57	.31	2.32
	(-.51)	(1.75)	(2.76)	(1.58)	(2.76)		
Mexico	2.38	.21	.09	-.09	.22	-.09	1.77
	(.43)	(.93)	(.44)	(-.41)	(.44)		
Spain	-4.61	.33	.36	.22	.91	.66	3.12
	(-1.53)	(2.36)	(4.13)	(2.04)	(4.13)		
Thailand	-2.39	.13	.21	.18	.53	.06	2.01
	(-.92)	(.96)	(1.55)	(.93)	(1.55)		
Colombia	-15.71	.58	.64	.39	1.60	.13	2.52
	(-1.14)	(1.64)	(1.94)	(1.12)	(1.94)		
Pakistan	-.72	-.01	.19	.30	.47	.19	1.88
	(-.30)	(-.10)	(1.84)	(2.01)	(1.84)		
Korea	17.87	-.25	-.11	.09	-.26	-.04	1.27
	(1.85)	(-1.23)	(-.69)	(.57)	(-.69)		
Taiwan	14.96	-.33	-.21	.01	-.53	.10	1.07
	(1.60)	(-1.65)	(-1.08)	(.06)	(-1.08)		
Yugoslavia	13.83	-.00	-.00	-.00	-.01	.08	1.19
	(4.18)	(-1.04)	(-1.69)	(-1.15)	(-1.69)		
Turkey	2.38	.05	.35	.48	.88	.11	2.19
	(.26)	(.11)	(1.22)	(1.70)	(1.22)		

Note: T statistics are shown below intercepts, coefficients and sum of coefficients, enclosed by parentheses, R^2 is the percent of variation in the dependent variable which is explained by variation in the independent variable. D-W is the Durbin-Watson statistic.

Table 20. Indicators of Price Influence ($\dot{P}_t$) on Economic Growth ($\dot{Y}_{*t}$)

$$\dot{Y}_{*t} = \rho_0 + \rho_1 \dot{P}_t$$

(Annual First Rates of Changes)

Country	ρ_0	ρ_1	R^2	D-W	Period
Pakistan	2.79	.29 (1.53)	.15	1.87	50-65
Mexico	5.57	.37 (1.29)	.13	2.70	53-65
Turkey	4.62	.09 (.65)	.05	2.06	55-65
Korea	5.42	.07 (.65)	.04	.97	55-67
Yugoslavia 3/	12.49	-.12 (-.18)	.00	2.13	56-64
Colombia	5.04	-.05 (-.34)	.01	2.91	50-65
Spain	7.60	-.16 (-.41)	.03	1.18	56-64
India 1/	7.87	-.17 (-1.01)	.08	1.72	53-66
Philippines	6.22	-.45 (-1.38)	.12	3.07	50-66
Brazil 2/	9.19	-.08 (-1.53)	.16	3.12	53-66
Argentina	5.88	-.10 (-2.12)	.24	2.18	50-66
Taiwan 2/	10.31	-.24 (-2.15)	.37	1.57	58-67
Thailand 2/	7.94	-1.12 (-3.71)	.67	1.75	57-65

Note: T statistics of regression coefficients are shown below each coefficient, enclosed by parentheses. R^2 is the percent of variation in the dependent variable which is explained by variation in the independent variable. D-W is the Durbin-Watson statistic.
1/ Real GNP has been substituted by industrial production.
2/ Real GNP has been replaced by real gross domestic product.
3/ Price is represented by producer's price.

Table 21. Indicators of Price Influence ($\dot{P}_t$, $\dot{P}_{t-1}$ and $\dot{P}_{t-2}$) Economic Growth ($\dot{Y}^*_t$)

$$\dot{Y}^*_t = \rho_0 + \rho_1\dot{P}_t + \rho_2\dot{P}_{t-1} + \rho_3\dot{P}_{t-2}$$

Annual First Rates of Changes - Almon Lag Results

Country	ρ_0	ρ_1	ρ_2	ρ_3	$\Sigma\rho$	R^2	D-W
Pakistan	5.70 (4.98)	-.16 (-1.05)	-.30 (-1.81)	-.29 (-1.95)	-.75 (-1.81)	.17	1.35
Turkey	7.29 (8.69)	.05 (1.31)	-.11 (-3.54)	-.22 (-4.90)	-.27 (-3.54)	.82	2.89
Korea	4.11 (2.70)	.13 (1.84)	.09 (2.20)	.00 (.07)	.22 (2.20)	.22	1.14
Mexico	6.03 (2.60)	.51 (2.61)	.07 (.45)	-.40 (-2.16)	.19 (.45)	.42	2.85
Yugoslavia	12.38 (1.61)	-1.13 (-2.22)	-.16 (-.37)	.89 (1.82)	-.41 (-.37)	.40	2.72
Colombia	4.35 (2.28)	-.05 (-.60)	.00 (-.26)	.05 (.45)	-.01 (-.26)	-.13	2.81
Spain	14.48 (6.59)	-.10 (-.66)	-.45 (-3.76)	-.57 (-3.61)	-1.12 (-3.76)	.72	2.68
India	9.04 (7.64)	-.14 (-1.00)	-.17 (-1.87)	-.12 (-.78)	-.42 (-1.87)	.12	2.12
Philippines	6.46 (3.88)	-.60 (-1.17)	-.18 (-1.08)	.34 (.85)	-.44 (-1.08)	-.04	2.09
Taiwan	11.28 (13.86)	-.16 (-2.18)	-.14 (-3.10)	-.05 (-.65)	-.36 (-3.10)	.51	1.81
Argentina	4.20 (1.40)	-.06 (-1.26)	-.01 (-.26)	.05 (.97)	-.02 (-.26)	-.01	2.42
Brazil	7.57 (3.41)	-.03 (-.57)	-.02 (-1.06)	-.00 (-.02)	-.05 (-1.06)	-.07	2.93
Thailand	8.03 (7.28)	-.84 (-2.93)	-.41 (-2.22)	.23 (1.08)	-1.02 (-2.22)	.49	1.10

Note: T statistics are shown below intercepts, coefficients and sum of coefficients, enclosed by parentheses. R^2 is the per cent of variation in the dependent variable which is explained by variation in the independent variable. D-W is the Durbin-Watson statistic.

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